Shaughnessy No.:501200

Date Out of EAB: JUN 23 1986

To: Henry Jacoby
Product Manager 21
Registration Division (TS-767)

From: Samuel M. Creeger, Chief
Review Section #1
Exposure Assessment Branch
Hazard Evaluation Division (TS-769)

Attached, please find the EAB review of...

Reg./File # : 372-AU

Chemical Name: Benodanil

Type Product : Fungicide

Product Name : BENEFIT

Company Name : Mallinckrodt

Purpose : Registration for use as a fungicide on turf and ornamentals

Date Received: 3/12/86

Action Code(s): 115

Date Completed: JUN 23 1986

EAB #(s) : 6409

Days: 1.5

Deferrals to: ____ Ecological Effects Branch

____ Residue Chemistry Branch

____ Toxicology Branch

Monitoring study requested by EAB: /__/

Monitering study voluntarily conducted by registrant: /__/

2073514

1.a CHEMICAL: Benodanil.
Benefit™
2-Iodobenzanilide

1.b Physical Properties:

Molecular weight: 323.1 g/mole.
Water solubility: 24 mg/l at 20°C.
Vapor pressure: $<0.1x10^{-1}$ mbar at 20°C.

2. TEST MATERIAL:

Two differently labeled compound were used (uniform labeling in the aromatic rings-see appendix).

3. STUDY/ACTION TYPE:

Application for the registration of BENEFIT fungicide for control of diseases on ornamentals and turf.

4. STUDY IDENTIFICATION:

Investigation into the Degradation of ^{14}C-Iodobenzanilide in Soil.

5. REVIEWED BY:

Akiva D. Abramovitch, Ph.D.
Chemist
Environmental Chemistry Review Section 1/EAB/HED/OPP

Abramovitch
JUN 23 1986
Date:

6. APPROVED BY:

Samuel M. Creeger, Chief
Supervisory Chemist
Environmental Chemistry Review Section 1/EAB/HED/OPP

Samuel M Creeger
JUN 23 1986
Date:

7. CONCLUSIONS:

Hydrolysis:

The hydrolysis data requirement remains unsatisfied. The enclosed hydrolysis data sheet cannot satisfy EAB data requirements since the data cannot be validated in the absence of experimental information and/or references. According to the submitted data, 2-iodobenzanilide does not undergo any significant hydrolysis at pH 5, 7 and 9 at 22°C and even at 70°C hydrolysis at pH 7 and 9 is extremely slow.

Aerobic Soil Metabolism:

The aerobic soil metabolism data requirement remains unsatisfied due to the several deficiencies associated with the report as stated in section 10.1 E.

2-Iodobenzanilide dissipated with half lives of 10-30 days in two soils but the identity of the degradates (other than carbon dioxide) was not reported and material balance was not provided.

Leaching and Adsorption/Desorption:

An aged soil column leaching study in two acidic soils was satisfactory and indicated that 2-iodobenzanilide and its degradates are not likely to leach and enter ground water in the two acidic soils that were studied. However, additional studies concerning unaged leaching and potential leaching in basic soils should be made available for evaluation before the leaching data requirement is satisfied. Therefore, we recommend an additional aged leaching study be conducted in a basic soil and parent compound leaching studies be conducted in 4 different soils.

8. RECOMMENDATIONS:

The following information should be relayed to the registrant:

Below are the data needed to support the proposed registration on turf and ornamentals their status:

Hydrolysis-not satisfied (not submitted).
Aerobic soil metabolism-not satisfied (this review, see above recommendations).
Leaching-not satisfied (this review, see above recommendations).
Aqueous Photolysis-not satisfied (not submitted).
Photolysis on Soil-not satisfied (not submitted).
Fish Accumulation-not satisfied (not submitted).
Field Dissipation-not satisfied (not submitted).

9. BACKGROUND:

A. Introduction: According to BASF (letter of Feb. 19, 1986) no data concerning benodanil have been submitted to EPA prior to this application for registration for use on ornamentals and turf for control of fungicides.

B. Directions for Use:

Please see attached directions for use.

10 DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

10.1 A. Study Identification: Investigation into the degradation of ^{14}C-labeled 2-Iodobezanilide in Soil.

The study was conducted by Soren Otto in 1977.

B. Materials and Methods:

Two soils (see attachment for characteristics) were fortified with radiolabeled 2-iodobenzanilide (5 ppm, 25 mg/5 kg) labeled separately in the two rings and incubated at 20°C at 40% m.h.c. for 120 days. Soil samples of 20 gm were taken after 0, 7, 14, 30, 60 and 120 days from the begining of the experiment. Soil samples were combusted to determine the total radioactive material. Other samples were extracted with methanol and the total amount of radioactive material was measured by LSC. The methanol was then concentrated, 50 ml of water were added and the aqueous fraction was extracted with 3x50 ml of benzene. The benzene fraction was

further analyzed by GLC and TLC and the aqueous fraction was discarded since it did not contain significant quantities of radioactive material. Soil samples that were initially extracted with methanol were further extracted with aqueous 20% NaOH and analyzed for radioactive material and then combusted to determine the residual radioactive material. During the incubation period acidic volatiles were trapped by 1 N sulfuric acid and carbon dioxide with phenylethyl amine. The amount of trapped radioactive material was quantified by LSC.

Thirty days after the start of the experiment, two 30 cm columns were each filled to a height of 20 cm with untreated soils and the top 10 cm with the thirty day treated soils and sprinkled daily for 45 days with 12.5 mm of water. The water filtered through the column was tested daily for radioactive material by LSC and the soil residues were determined by combustion at the end of the experiment.

C. Reported Results:

The degradation half-life for 2-iodobenzanilide ranged between 10-35 days. Only 2-iodobenzanilide was detected in the methanol extract and no methanol soluble degradation products were formed. In one experiment, evolution of $^{14}CO_2$ reached a maximum level of 30% within a 45 day period.

In washing out soils, in both soils in which 2-iodobenzaanilide was incubated for 30 days, there was very little movement in the Neuhofen soil and only some movement in the Hatzenbuhl soil to the 5 cm level below the 2-iodobenzanilide treated soil after daily addition of 12.5 mm of water for 45 days.

D. Study Author's Conclusions:

No additional conclusions to those stated in the reported results, above.

E. Reviewer's Discussion and Interpretation of Study Results:

The study did not fully satisfy the aerobic soil degradation or the aged leaching data requirement. The data was not assigned to either one of the two different radiolabeled chemicals making it difficult to interpret the results of this study. Although the study showed that 2-iodobenzanilide dissipated with half lives of 10-35 days in the two soils that were studied (both acidic), the major degradation products (other than carbon dioxide) were not identified and material balance was not provided. Information should be made available concerning the potential formation of aniline as a degradate and its leaching into ground water through neutral and basic soils (in addition to acidic soils that were used in the above studies).

11. COMPLETION OF ONE LINER:

Not initiated.

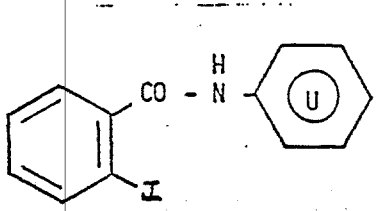
12. CBI APPENDIX:

Attachment.

2. Labelled substances

Two differently labelled substances were used.

a) 2-iodobenzanilide (1'-6'-^{14}C)



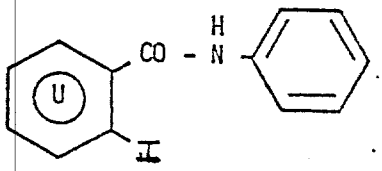
molecular formula: $C_{13}H_{10}INO$

molecular weight: 323.14

spec. activity: 9.78 ± 0.19 mCi/mMol

This compound was synthesised by Herr Dr. Burger,
WA/Ammon labor

b) 2-iodobenzanilide (iodophenyl-U-^{14}C)



spec. activity: 17.7 mCi/mMol

This compound was synthesised by NEN (New England Nuclear),
Boston/USA

4. Experiment to wash out the active substance and its degradation products after 30 days.

At the end of the experiment (washing out period of 45 days), the following distribution of ^{14}C-residues was found in the soil sections (see diagram 2) after measuring the activities:

Table 3: Washings from Neuhofen soil (period of decay: 30 days)

Segment no.	µg equivalents ^{14}C-iodobenzanilide	% of total ^{14}C-activity recovered
1	234.99	44.67
2	260.08	49.43
3	16.76	3.19
4	3.90	0.74
5	1.93	0.37
6	1.26	0.24
7	0.76	0.14
	519.68	98.78
In filtered water:	6.43	1.22

(For calculations see table 16 which is attached)

Table 4: Washings from Ratzenbühl soil (period of decay: 30 days)

Segment no.	µg equivalents ^{14}C-iodobenz-anilide	% of total ^{14}C-activity recovered
1	246.63	20.09
2	605.34	49.30
3	310.48	25.29
4	37.88	3.09
5	5.97	0.48
6	3.75	0.31
7	1.43	0.12
	1211.48	98.68
In filtered water:	16.28	1.32

(For calculations see table 17 which is attached)

As the results in tables 3 and 4 show, washing out of the active substance and its degradation products is negligible even under the strongly favourable conditions of the experiment.

immediately flush eyes or skin with plenty of [illegible]. Wash thoroughly with soap [illegible] clothing and respirator when mixing and applying pesticides. Wash thoroughly with soap [illegible] contaminated clothing before reuse. Do not contaminate feed or food. Keep children and pets out of treated area during application. Avoid spraying in greenhouse aquaria containing valuable tropical fish.

ENVIRONMENTAL HAZARDS

THIS PRODUCT IS TOXIC TO FISH. Do not apply directly to water. Do not contaminate water by cleaning of equipment or disposal of wastes. Not dangerous to honey bees.

DIRECTIONS FOR USE

IT IS A VIOLATION OF FEDERAL (U.S.A.) LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

Add recommended amount to a partially filled spray tank under agitation. Complete filling to the desired volume. Keep agitated to insure even suspension of material. Make fresh daily. Spray uniformly over the area with a boom-type or other power sprayer.

TURF

Apply after mowing or avoid mowing for 12 hours after application. Apply in sufficient water to obtain thorough coverage, usually 2-4 gal. per 1000 sq. ft. of turf area. Always treat aprons and approaches to golf greens. Under conditions of severe disease, apply every 5 to 7 days. Note to users: Do not apply to areas likely to be grazed by livestock and do not feed clippings to livestock or poultry.

Use on golf course greens, tees, lawn and fairways of Bentgrasses, Bluegrasses, Fescues, Bermudagrasses, Ryegrasses, St. Augustine grass or their mixtures for the prevention and control of the following diseases:

BROWN PATCH (Rhizoctonia solani), YELLOW PATCH (Rhizoctonia cerealis) or RED THREAD (Corticium fuciforme). Apply at 1 to 2 oz. per 1000 sq. ft. when disease first appears and retreat at 10-14 day intervals, as required.

RUST (Puccina coronata). Apply at 4 to 8 oz. per 1000 sq. ft. Repeat in 14 days, if required.

FAIRY RINGS (Marasmius oreades). Pierce the area with a fork. Apply fine sand over the pierced areas and irrigate with 0.1% WET-TERRA™. Apply BENEFIT™ at 2 oz. per 10 sq. ft. in 5 gal. of water. A second treatment in 3-4 mo. may be necessary.

ORNAMENTAL & NURSERY CROPS

SOIL DRENCH

For control of Rhizoctonia spp. and Sclerotium rolfsii.

BEDDING PLANTS: Apply 2-3 oz. BENEFIT™ per 100 gal. of water. Apply once at seeding, at transplant, and every 8 weeks thereafter.

FLOWERING, FOLIAGE, WOODY and BULB PLANTS: Apply 4-8 oz. BENEFIT™ per 100 gal. water every 6-8 weeks.

SOIL INCORPORATION AND BULB DIP

For control of Rhizoctonia spp. and Sclerotium rolfsii on bulb plants only. Incorporate 1-3 oz. BENEFIT™ cu. yd. soil at time of planting and/or DIP bulbs in 1 lb. per 10 gal. suspension before planting.

FOLIAR SPRAY

For control of aerial Rhizoctonia spp. and rust species, (Cronartium[1], Endocronartium[2], Melampsora[3], Phragmidium[4], Puccinia[5], Uredinopsis[6], Uromyces[7]).

FLOWERING, FOLIAGE and WOODY PLANTS: Apply to glisten 1-3 lb. BENEFIT™ per 100 gal. of water at first signs of the disease and retreat at 7 to 14 day intervals.

The following ORNAMENTAL and NURSERY PLANTS are subject to the diseases BENEFIT™ controls and are tolerant to normal rates of application.

BEDDING PLANTS	FOLIAGE	WOODY
Achillia	Aglaonema (D)	Azalea (D,S)
Acroclinium	Cissus (S)	Balsam fir[4] (S)
Ageratum	Dieffenbachia (D)	Cotoneaster (D)
Ajuga	Dracena (D,S)	Douglas fir[3] (S)
Alyssum	Fatsia (D)	Ilex (D)
Aster	Fern, Boston (D)	Juniper (D)
Begonia	Fittonia (D)	Pine[1,2] (S)
Carnation*	Hedera (D,S)	Pittosporum (D)
Celosia	Hoya (D)	Raphiolepsis (D)
Chrysanthemum	Peperomia (D)	Rhododendron (D)
Coleus*	Philodendron (D,S)	
Cosmos*	Pothos (D)	
Dahlia	Sansevieria (D)	
Dianthus*	Schefflera (D,S)	
Flowering Cabbage	Spathiphyllum (D,S)	
Gazania	Syngonium (D,S)	
Geranium*		
Gerbera Daisy	Soil drench (D) or foliar spray (S)	Soil drench (D) or foliar spray (S)
Globe Amaranth		
Gypsophila		
Helichrism		
Hibiscus		
Impatiens*		
Kochia		
Marigold		
Mimulus		
Nicotiana		
Pansy		
Pepper, Ornamental		
Petunia*		
Phlox		
Salpiglosus		
Salvia		
Shasta Daisy		
Snapdragon*		
Statice		
Sweet Sultan		
Sweet William*		
Tithonia		
Torenia		
Tritoma		
Vinca		
Zinnia		
Soil drench only.		
*Some cultivars may be sensitive.		

FLOWERING	BULBS
Calceolaria (D)	Daffodil
Carnation[7] (S)	Gladiolus
Chrysanthemum (D)	Lily
Cineraria (D)	Tulip
Cyclamen (D)	
Geranium[3] (D,S)	
Gloxinia (D)	
Hydrangea (D)	
Poinsettia (D)	
Primrose (D)	
Rose[4] (S)	
	NOTE USES:
Soil drench (D) or foliar spray (S)	Soil drench, soil incorporation and bulb dip.

NOTE: The rust include Cronartium[1], Endocronartium[2], Melampsora[3], Phragmidium[4], Puccinia[5], Uredinopsis[6], Uromyces[7].

STORAGE AND DISPOSAL

STORAGE: Not sensitive to light. Stable at normal temperatures and humidities. Store in a dry place in a well-closed container.

PROHIBITIONS: Do not contaminate water, food, or feed by storage or disposal. Open dumping is prohibited.

PESTICIDE DISPOSAL: Pesticide, spray mixture or rinse water that cannot be used according to label instructions must be disposed of according to applicable Federal, State or local procedures.

CONTAINER DISPOSAL: Completely empty bag by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of bags in a sanitary landfill or by incineration if allowed by State and local authorities.

WARRANTY

This material conforms to the description on the label and is reasonably fit for the purposes referred to in the directions for use. Timing and method of application, weather, water practices, nature of soil or potting medium, the disease problem, condition of the crop, incompatibility with other chemicals not specifically recommended, and other influencing factors in the use of this product are beyond the control of the seller. Buyer assumes all risks of use, storage or handling of this material not in strict accordance with directions given herewith. NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY IS MADE.

contaminated clothing before reuse. Do not contaminate food or feed [illegible] application. Avoid spraying in greenhouse aquaria containing valuable tropical fish.

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BROWN PATCH (**Rhizoctonia solani**), YELLOW PATCH (**Rhizoctonia cerealis**) or RED THREAD (**Corticium fusiforme**). Apply at 1 to 2 oz. per 1000 sq. ft. when disease first appears and retreat at 10-14 day intervals, as required.

RUST (**Puccina coronata**). Apply at 4 to 8 oz. per 1000 sq. ft. Repeat in 14 days, if required.

FAIRY RINGS (**Marasmius oreades**). Pierce the area with a fork. Apply fine sand over the pierced areas and irrigate with 0.1% WET-TERRA™. Apply BENEFIT™ at 2 oz. per 10 sq. ft. in 5 gal. of water. A second treatment in 3-4 mo. may be necessary.

ORNAMENTAL & NURSERY CROPS

SOIL DRENCH

For control of **Rhizoctonia** spp. and **Sclerotium rolfsii**.

BEDDING PLANTS: Apply 2-3 oz. BENEFIT™ per 100 gal. of water. Apply once at seeding, at transplant, and every 8 weeks thereafter.

FLOWERING, FOLIAGE, WOODY and BULB PLANTS: Apply 4-8 oz. BENEFIT™ per 100 gal. water every 6-8 weeks.

SOIL INCORPORATION AND BULB DIP

For control of **Rhizoctonia** spp. and **Sclerotium rolfsii** on bulb plants only. Incorporate 1-3 oz. BENEFIT™ cu. yd. soil at time of planting and/or DIP bulbs in 1 lb. per 10 gal. suspension before planting.

FOLIAR SPRAY

For control of aerial **Rhizoctonia** spp. and rust species, (**Cronartium**[1], **Endocronartium**[2], **Melampsora**[3], **Phragmidium**[4], **Puccinia**[5], **Uredinopsis**[6], **Uromyces**[7]).

FLOWERING, FOLIAGE and WOODY PLANTS: *Apply to glisten 1-3 lb.* BENEFIT™ per 100 gal. of water at first signs of the disease and retreat at 7 to 14 day intervals.

The following ORNAMENTAL and NURSERY PLANTS are subject to the diseases BENEFIT™ controls and are tolerant to normal rates of application.

BEDDING PLANTS	FOLIAGE	WOODY
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Ageratum	*Dieffenbachia* (D)	Cotoneaster (D)
Ajuga	Dracena (D,S)	Douglas fir[3] (S)
Alyssum	Fatsia (D)	Ilex (D)
Aster	*Fern, Boston* (D)	Juniper (D)
Begonia	Fittonia (D)	Pine[1,2] (S)
Carnation*	Hedera (D,S)	Pittosporum (D)
Celosia	*Hoya* (D)	*Raphiolepsis* (D)
Chrysanthemum	Peperomia (D)	Rhododendron (D)
Coleus*	Philodendron (D,S)	
Cosmos*	*Pothos* (D)	
Dahlia	Sansevieria (D)	
Dianthus*	Schefflera (D,S)	
Flowering Cabbage	*Spathiphyllum* (D,S)	
Gazania	Syngonium (D,S)	
Geranium*		
Gerbera Daisy		
Globe Amaranth	Soil drench (D) or	Soil drench (D) or
Gypsophila	foliar spray (S)	foliar spray (S)
Helichrism		
Hibiscus		
Impatiens*		
Kochia		
Marigold		
Mimulus		
Nicotiana		
Pansy		
Pepper, Ornamental		
Petunia*		
Phlox	FLOWERING	BULBS
Salpiglosus		
Salvia	Calceolaria (D)	Daffodil
Shasta Daisy	Carnation[7] (S)	Gladiolus
Snapdragon*	Chrysanthemum (D)	Lily
Statice	Cineraria (D)	Tulip
Sweet Sultan	Cyclamen (D)	
Sweet William*	Geranium[5] (D,S)	
Tithonia	Gloxinia (D)	
Torenia	Hydrangea (D)	
Tritoma	Poinsettia (D)	
Vinca	Primrose (D)	
Zinnia	Rose[4] (S)	
Soil drench only.		NOTE USES:
*Some cultivars may be sensitive.	Soil drench (D) or foliar spray (S)	Soil drench, soil incorporation and bulb dip.

NOTE: The rust include **Cronartium**[1], **Endocronartium**[2], **Melampsora**[3], **Phragmidium**[4], **Puccinia**[5], **Uredinopsis**[6], **Uromyces**[7].

STORAGE AND DISPOSAL

STORAGE: Not sensitive to light. Stable at normal temperatures and humidities. Store in a dry place in a well-closed container.

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WARRANTY

This material conforms to the description on the label and is reasonably fit for the purposes referred to in the directions for use. Timing and method of application, weather, water practices, nature of soil or potting medium, the disease problem, condition of the crop, incompatibility with other chemicals not specifically recommended, and other influencing factors in the use of this product are beyond the control of the seller. Buyer assumes all risks of use, storage or handling of this material not in strict accordance with directions given herewith. NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY IS MADE.

2 LB.
(0.9 Kg)

BENEFIT™

50% WETTABLE POWDER

FUNGICIDE
FOR
CONTROL OF DISEASES
ON ORNAMENTALS AND TURF

ESPECIALLY EFFECTIVE ON
RHIZOCTONIA AND RUST DISEASES

ACTIVE INGREDIENT:	
2-Iodobenzanilide	50%
INERT INGREDIENTS:	50%

KEEP OUT OF REACH OF CHILDREN

CAUTION

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. **GET MEDICAL ATTENTION IMMEDIATELY.**

IF ON SKIN, wash thoroughly with soap and water.

IF IN EYES, flush immediatley with plenty of water for at least 15 minutes. **GET MEDICAL ATTENTION.**

SEE BACK PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS.

EPA Registration No. 372-
EPA Establishment No. 602-MO-1

MANUFACTURED FOR

MALLINCKRODT, INC.
ST. LOUIS, MISSOURI 63147